

# THE MINERAL INDUSTRY OF REPUBLIC OF KOREA

By Chin S. Kuo<sup>1</sup>

The country's gross domestic product grew 8.2% in 1994, led by rising capital investment by Korean conglomerates and heavy exports. After a 2-year slowdown, the export-driven economy recovered rapidly, largely because of the falling dollar to which the local currency was closely tied. That the Japanese yen appreciated against the dollar gave Korean manufacturers a price advantage over their Japanese rivals. A relatively quiet round of annual labor negotiations was another factor. The waning influence of radical union leaders was an important structural change. However, surging imports of capital goods in line with the continuing economic expansion caused a widening of the trade deficit and thus the current account deficit.

Foreign investment in the Republic of Korea recovered to its highest level in 3 years, up 26% from a year earlier at \$1.31 billion.<sup>2</sup> Japan accounted for \$430 million of foreign investment, an increase of 51% from 1993. However, the country attracted only 2% of direct investment by foreigners in Asia's developing countries.

## Government Policies and Programs

Effective July 1, 1994, foreign businesses that do not require Government approval could be launched upon filing an application. The waiting period for projects needing Government approval would be cut from 30 to 5 days. A revised law also would lift a ban on foreign investment in sectors that are heavy users of energy or imported raw materials, and those that receive subsidies.

The Government completed measures to boost foreign investment by opening more sectors to overseas businesses by January 1997, easing the entry process, and offering investment incentives. A one-stop assistance center was to be set up for foreign interests. An industrial complex will be built in the cities of Kwangju and Chunan for foreign investors to lease land at a discount for 10 years. Foreign firms will be exempt from taxation for 5 years after they log earnings. A ban on corporate borrowing abroad, investment in overseas real estate, and ownership of foreign stocks and bonds will be eased. Firms that are majority-owned by foreigners will be treated the same as domestic companies in seeking credit guarantees.

The Government will abolish tariffs on all copper products by 2004 while raising other nonferrous metal tariffs to between 10% and 13% beginning in 1995. All copper products include cathode, wire, and scrap on which tariffs of

5% to 10% are currently applied.

## Production

Anthracite coal production has been decreasing steadily in the past 5 years. In 1994, output amounted to 7.14 million metric tons (Mmt), a decrease of 19% from that of 1993. Metal mining, such as iron and lead, showed slight increases over those of 1993. However, mine production of zinc declined 9%, as compared with the 1993 output. Owing to continued construction activities, cement output registered a 10% increase. The iron and steel industry experienced about the same level of production as that of 1993: pig iron decreased by 3% while crude steel increased by 2%. (*See table 1.*)

## Trade

Bilateral trade between the Republic of Korea and North Korea slumped in the first half of 1994 and rose again in July. The Republic of Korea's purchases of North Korean goods included gold, zinc, and textiles, while the sales to North Korea were mostly textiles, chemicals, and furniture.

Pohang Iron and Steel Co. Ltd. (Posco) purchased a 13,000-metric-ton-per-year (mt/a) service center in Kita-Kyushu, Japan, from Fukuoka Steel Industry Co. of Japan for \$11.1 million. The service center, completed only 4 years ago at a cost of \$14.4 million, has the latest equipment. Posco shipped about 2 million metric tons per year (Mmt/a) of steel to Japan. Mitsubishi Motors Corp. of Japan was expected to buy 6,000 mt/a of cold-rolled steel sheets from Posco beginning in 1995. Meanwhile, Cascade Steel Rolling Mills Inc. of the United States made three 5,000-metric-ton (mt) reinforcing bar shipments to the Republic of Korea. The country exported 160,000 mt of stainless steel to North America and Europe.

The country imported about 400,000 mt/a of potash and the market was dominated by Canada. Lately, the former Soviet Union and Jordan were increasing their share of the market.

The Republic of Korea is largely dependent on imports for its energy. Petroleum, shipped from the Middle East, and coal, obtained locally and from imports, were the primary energy needs.

## Structure of the Mineral Industry

The Government was expected to dispose of its 35% stake in Posco, valued at about \$8.6 billion, as part of a massive privatization program. Posco enjoyed a monopoly on the country's steel industry.

Small companies wanted the Government to allow more foreign workers into the country to meet a worsening labor shortage. So far, 20,000 foreign workers allowed in were insufficient, but 30,000 more were needed by yearend. (*See table 2.*)

## Commodity Review

### Metals

**Copper.**—PMX Industries Inc. is Poongsan Corp.'s U.S. subsidiary in Cedar Rapids, Iowa, which produces flat-rolled brass. The company operates a sheet and strip plant with a capacity of 120,000 mt/a. It underwent a management overhaul from a construction and startup company to a more productive and customer-oriented company. The increased productivity and sales were expected to improve the parent company's overseas operation and profitability.

**Gold.**—The Republic of Korea produced about 25 mt of gold and consumed 15 to 18 mt/a. A 10% value-added tax was levied on imports of gold ingots, but the import duty on gold was cut to 3%. Lucky Metal Corp. is one of the two gold refiners. The other is Korea Zinc Co., Ltd.

**Iron and Steel.**—Posco's iron ore intake, despite a healthy rise in domestic steel demand, dipped slightly to 31.5 Mmt from 33.4 Mmt in 1993. The country's largest steelmaker was capable of producing 22.5 Mmt/a of crude steel. The company planned to expand its capacity by 5.9 Mmt/a to 28.4 Mmt/a. The increase in capacity would be achieved by expanding its electric-arc furnace operation and by including thin-slab casting. Capital investment, including outlays for pollution-control facilities, would amount to \$18.4 billion by the end of the decade.

Posco planned to build a thin-slab casting plant, with a capacity of 1 Mmt/a in the first phase and rising to 2 Mmt/a, at its Kwangyang works. Construction of the new plant would begin in early 1995 and be completed in September 1996. An in-line strip production process technology was to be used. Posco was to acquire two 130-mt electric furnaces, along with a ladle furnace and other equipment for a total value of \$19 million from Nippon Steel Corp. of Japan. An additional twin-furnace electric-arc system was to be supplied. This unit was expected to come on-stream in December 1996. It was estimated that the country could have as much as 10 Mmt/a of thin-slab-based strip production capacity by the year 2000.

Posco ordered a 90-mt electric furnace, converter, and caster worth \$49 million from Voest Alpine Industries of

Austria for its new stainless steel plant. The new plant would have a capacity of 420,000 mt/a, doubling Posco's stainless steel capacity.

Posco and Davy of the United Kingdom were to build a pilot strip-casting plant at Pohang to produce stainless steel strip from 2 to 6 millimeters (mm) thick and 1,300 mm wide. Posco was to spend \$64 million and Davy \$14 million on the project.

Posco and Vietnam Steel Corp. (VSC) began constructing a 200,000-mt/a bar plant at Haiphong, Vietnam, in a 50/50 joint venture. The plant would roll imported billets into round and reinforcing bars and wire rods and was expected to be completed in September 1995. The bulk of the billets needed for the plant would probably be imported from Russia. Posco operated a 30,000-mt/a galvanizing plant, near Ho Chi Minh City, Vietnam, in a joint venture with Southern Steel Union of Vietnam. Posco and VSC were building a 30,000-mt/a pipe plant in Haiphong, Vietnam, with Posco supplying the hot strip; construction was completed in April 1994.

Posco and Nippon Steel Corp., Kawasaki Steel Corp., and Mitsui & Co., all of Japan, planned to produce cold-rolled steel sheets at Mab Ta Pud, Thailand, with the Siam Cement Group of Thailand. The consortium was expected to invest up to \$571 million in facilities to produce 1 Mmt/a of steel sheets. Construction would begin in 1997.

Hanbo Steel, a minimill, was to buy two 155-mt electric furnaces from NKK Corp. of Japan for its new hot-rolled coil and bar plant being constructed at Asan Bay. The plant was to come on-stream by March 1995. Hanbo also considered construction of a cold-rolled steel plant with a capacity of 2 Mmt/a. Production would likely begin in 1999.

Hanbo Steel signed a contract with Voest Alpine Industries of Austria for two Corex ironmaking plants that would feed iron to electric furnaces for the production of automotive-quality sheet steel. The contract, worth more than \$184 million, was signed in September 1994. Midrex Direct Reduction Corp. of the United States, a subcontractor, was to install a direct-reduction iron plant with a capacity of 800,000 mt/a. Startup of the plant was expected in 1997.

Union Steel Manufacturing planned to build a new 300,000-mt/a hot-dip galvanizing line at its Pusan works to further increase its cold-rolling capacity. The company could then produce about 900,000 mt/a of cold rolls. Mannesmann Demag of Germany was selected to build the line that was due for commissioning in April 1996. The new line would produce strip of ranging in thickness from 0.23 to 2.3 mm and up to 1,270 mm wide. Union Steel had the capacity to produce about 300,000 mt/a of electric resistance welded (ERW) tubes.

Korea Steel Pipe (KSP), the third largest steel pipe producer in the country, filed for receivership with the Seoul District Court. The company's debts were estimated to top \$297 million. KSP's difficulties sprang from over-extending itself in an attempt to modernize and expand its facilities. It operated a 1.27- to 30.48- centimeters (cm), 400,000-mt/a capacity ERW pipe mill near Incheon. KSP had planned to

open a new 300,000-mt/a plant near Kwangyang producing pipes from 20.32 to 60.96 cm in diameter; the plant initially was to be commissioned in September 1994, but was not completed. Shin Ho Paper Manufacturing Co. bailed out KSP for an undisclosed stake.

Dongkuk Steel Mill planned to build melting and slab casting capacity at its Pohang works. An electric furnace was to be installed on a site adjacent to its existing 700,000-mt/a plate mill for commissioning by 1997. The company also has a 300,000-mt/a plate facility at its Inchon works. Dongkuk Steel, the country's largest maker of bars, has melting and rolling facilities at Pusan and Inchon with a combined 2-Mmt/a capacity.

Kangwon Industries' new 1.2-Mmt/a mill at Pohang, producing H-beam, steel sheet pile, and heavy rail, reached full capacity in June after commissioning in December 1993. The Pohang works previously produced 1.5 Mmt/a of rebar and sections. Semimanufactures for sheet piling and rail production were obtained from Posco. Inchon Iron and Steel was another H-beam producer with a capacity of about 1 Mmt/a.

**Lead and Zinc.**—Korea Zinc Co. reopened its 100,000-mt/a lead smelter near Onsan in September after a 2-week maintenance shutdown. The plant had been operating at nearly full capacity and had enough lead concentrates on hand to meet its smelting needs. Lead output in 1994 was around 80,000 mt and production in 1995 was forecasted to be 100,000 mt. Lead concentrates were purchased from Australia, Canada, and South America. The country's consumption of lead was estimated at 160,000 mt/a and Korea Zinc supplied most of its production to the domestic market.

Korea Zinc planned to build a 125,000-mt/a plant costing about \$21 million to produce zinc fume from goethite, jarosite, and primary leach residue. The plant was expected to be commissioned in May 1995. The technology provided by Ausmelt of Melbourne, Australia, was expected to recover up to 98% of the zinc from waste residue containing an average of 15% zinc. Korea Zinc produced about 250,000 mt/a of zinc from a QSL plant.

Korea Zinc (50%), Cominco Ltd. (25%), and Teck Corp. (25%), the latter two based in Canada, acquired Sa Dena Hes and Cirque properties from Curragh Resources of Canada, for about \$35 million. The Sa Dena Mine, with a throughput of 1,500 metric tons per day, produced 150,000 mt/a of zinc concentrate, but was idle since December 1992. Neither was a great increase in exploration activity reported at Cirque.

Korea Zinc agreed to buy a 40% stake for \$28.5 million in the Elura zinc/lead mine in New South Wales from Pasmaico Ltd. of Australia. The company also acquired a 40% interest in other associated mine assets, including the loading facility at the Port of Newcastle. The mine had the capacity to treat 1.2 Mmt/a of ore, producing about 75,000 mt/a of zinc concentrate. Korea Zinc had been a long-term customer of Pasmaico.

## **Industrial Minerals**

**Cement.**—Hyundai Cement Co. completed the expansion in one of its two plants to increase the total capacity to 7 Mmt/a. The expansion at a cost of \$123.6 million was designed to add production lines with a capacity of 2 Mmt/a to the 2-Mmt/a plant at Youngweol. The company had a 3-Mmt/a cement plant at Tangyang.

## **Mineral Fuels**

**Coal.**—The Republic of Korea imported bituminous coal from Australia, Canada, China, and the United States. Korean importers had made efforts to diversify their sources and were expanding imports from the world spot market. The volume of imports stayed much the same as in 1993 and was expected to increase slightly in the near future. Coking coal demand was projected to rise as well.

The country's coal industry has observed a shift by Korean households from coal briquettes to cleaner fuels, such as liquefied petroleum gas and natural gas. A sharp decrease in domestic demand and rising imports of cheaper coal from China have prompted coal companies to move into the gas business and have the state Korea Gas Corp. privatized. The refining giants associated with business conglomerates, such as Hyundai and Honam oil refinery companies, also were keen to buy a stake in Korea Gas. An auction was scheduled for 1995. Currently, Korea Gas is 50% owned by the Government, 34.7% by the state-run Korea Electric Power Corp., and the remainder by regional governments.

The major coal developers, including Korea Electric Power Corp., were involved in overseas coal mining through consortia. Dae Sung Resources Corp. established a subsidiary in Australia for coal development and for import to the Republic of Korea. Only Hanbo Energy Corp. was actively engaged in coal and oil exploration and production. The company supplied 7% of the country's total anthracite output. Hanbo Energy signed a contract with an Iraqi state-run oil company to participate in an oil development project in Iraq beginning in 1995.

Ten miners died on the spot from a poisonous gas leak at a coal mine in Kangwon Province in October. Six others were still in the mine and presumed dead.

**Petroleum.**—Mi Chang Oil Industry Co., the third largest maker of lubricating oil in the country, has had a technological cooperation agreement with Mitsubishi Oil Co. of Japan since 1986. The latter was to take a 10% equity stake valued at \$694,000 in the former to make and sell high-quality lubricating oil in the Korean market. Part of the investment was to be used to construct a new refining facility at a plant in Ulsan.

## **Reserves**

The Republic of Korea is a mineral resource-poor country.

Anthracite coal is the most important mineral commodity. Indigenous metallic minerals include ores of lead and zinc and tungsten. Mining of the latter ceased because of market competition and world prices. Several industrial minerals with a large share of world production include diatomaceous earth, feldspar, graphite, mica, pyrophyllite, and talc. (*See table 3.*)

### **Infrastructure**

Insufficient investment in infrastructure was hindering the country's international competitiveness and creating economic losses. The Government planned to allocate \$8.6 billion of its 1995 budget to infrastructure development and enact a law to attract private investment in this sector.

Korea Electric Power Corp. signed an agreement with Nuclear Electric Co. Ltd., based in London and providing electricity for England and Wales, for cooperative exchange of information, expertise, and staff. The country's nuclear power capacity could be tripled to about 20,000 megawatts (MW) by 2006. Currently, the electricity generating capacity was about 26,760 MW.

The power company also signed a contract worth nearly \$500,000 with General Electric's Power Systems unit of the United States to expand the Seoinchon powerplant. Four combined-cycle power generating units were to be provided to increase the capacity by 2,000 MW.

### **Outlook**

The country's rate of economic growth is expected to slow to about 7%. As the Korean won further strengthens against the

dollar, growth in exports is expected to slow. Expansion in 1995 probably will be fueled by consumer spending and construction activity. Annual inflation is predicted to increase to 5% as demand increases while supplies of farm goods are tight. Labor shortages and less government intervention in the labor market will cause wage increases. Large infrastructure development projects will inflate real estate prices.

Privatization and globalization are expected to continue for the country's steel industry. Posco will soon sell stock to the public as the state-owned company has been dominant in domestic flat-rolled steel business for so long. The Government's accelerated financial reform and openness of its market to foreign competition will liberalize the industry and make it more international in scope in the future.

---

<sup>1</sup>Text prepared Apr. 1995.

<sup>2</sup>Where necessary, values have been converted from Korean won (W) to U.S. dollars at the rate of W810=US\$1.00 for 1994.

### **Major Sources of Information**

Korea Institute of Geology, Mining, and Materials  
30, Kajungdong, Yusongku, Taejon  
Ministry of Energy and Resources  
1, Chungang-dong, Kwach on, Kyonggi, Seoul

### **Major Publications**

Economic Planning Board, Seoul:  
Monthly Statistics of Korea  
Ministry of Energy and Resources, Seoul:  
Yearbook of Energy Statistics

TABLE 1  
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES<sup>1/ 2/</sup>

(Metric tons unless otherwise specified)

Commodity	1990	1991	1992	1993 e/	1994 e/
<b>METALS</b>					
Aluminum, primary	2,000	--	--	--	--
Bismuth metal	79	42	9	5	--
Cadmium, smelter e/	500	450	620	400	400
Copper:					
Mine output, Cu content	53	5	4 e/	5	5
Metal:					
Smelter	186,000	202,000 e/	210,000 e/	220,000	224,000
Refined, primary	183,000 e/	202,000	209,000	218,000	222,000 3/
Gold metal kilograms	20,800	20,800	23,300	25,000	25,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	298	222	222	219 3/	191 3/
Fe content do.	180	134	134	122 3/	115
Metal:					
Pig iron do.	15,300	18,500	19,300	22,000	21,200 3/
Ferroalloys:					
Ferromanganese	84,000	94,900	85,900	101,000 3/	120,000 3/
Ferrosilicon	2,000	18,900	18,200	55 3/	-- 3/
Ferrosilicomanganese	82,800	74,200	82,600	82,000 3/	89,000 3/
Other	16,100	--	--	2,750 3/	3,080 3/
Total	185,000	188,000	187,000	185,000 3/	212,000 3/
Steel, crude thousand tons	23,100	26,000	28,100	33,000 3/	33,700 3/
Lead:					
Mine output, Pb content	14,900	12,600	13,600	14,800 3/	15,000
Metal, smelter	61,000 e/	40,600	63,000	88,000	76,000
Molybdenum, mine output, Mo content	103	144	--	--	--
Silver metal kilograms	238,000	265,000	333,000	215,000 3/	258,000 3/
Tungsten, mine output, W content	1,360	780	247	200	--
Zinc:					
Mine output, Zn content	22,800	22,000	21,900	27,600 3/	25,000
Metal, primary	248,000	254,000	253,000	272,000	250,000
<b>INDUSTRIAL MINERALS</b>					
Asbestos	1,530	1,500 e/	2,310	2,200	2,000
Barite	2,920	1,010	40	50	50
Cement, hydraulic thousand tons	33,600	35,000	44,400 r/	47,300 3/	52,100 3/
Clays, kaolin	1,450,000	1,760,000	1,860,000	2,330,000 3/	2,600,000 3/
Diatomaceous earth	55,400	91,100	76,800	67,300 3/	70,000
Feldspar	237,000	248,000	282,000	539,000 3/	500,000
Fluorspar, metallurgical-grade	560	290	70	50 3/	50
Graphite:					
Crystalline	703	1,550	8,410	5,910 3/	6,000
Amorphous	99,000	75,200	75,000 e/	72,000	72,000
Total	99,700	76,800	83,400 e/	77,900	78,000
Kyanite and related materials: Andalusite	--	14	38	30	30
Mica, all grades	4,770	5,130	7,730	7,500	7,600
Nitrogen: N content of ammonia	411,000	407,000	442,000	450,000	460,000
Salt	617,000	696,000	772,000	750,000	760,000
Soda ash, manufactured e/	280,000	300,000	300,000	310,000	310,000
Stone, sand and gravel:					
Limestone thousand tons	48,900	59,200	65,400	76,900 3/	82,800 3/
Quartzite do.	1,450	1,630	1,870	2,510 3/	2,400
Sand including glass sand do.	1,410	1,350	1,270	1,120 3/	1,400
Sulfur, byproduct:					
Metallurgy do.	221	229	260	263	250
Petroleum do.	65	65	100	200	200
Total do.	286	294	360	463	450
Talc and related materials:					
Pyrophyllite	658,000	573,000	603,000	645,000 3/	650,000
Talc	182,000	171,000	150,000	53,900 3/	60,000

See footnotes at end of table.

TABLE 1--Continued  
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES<sup>1/ 2/</sup>

(Metric tons unless otherwise specified)

Commodity	1990	1991	1992	1993 e/	1994 e/	
<b>MINERAL FUELS AND RELATED MATERIALS</b>						
Carbon black	215,000	231,000	248,000 r/	300,000 3/	311,000 3/	
Coal, anthracite	thousand tons	17,200	14,900	11,100 r/	8,850 3/	7,140 3/
Coke e/	do.	5,500	5,600	5,600	5,800	5,700
Fuel briquet, anthracite briquets		18,800	15,000	11,100	12,000	11,000
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	24,000	28,900	30,000 e/	38,000	37,000
Jet fuel e/	do.	9,600	9,700	9,700	9,800	9,800
Kerosene	do.	13,900	14,500	15,000 e/	29,000	30,000
Distillate fuel oil	do.	94,800	128,000	130,000 e/	165,000	170,000
Residual fuel oil	do.	98,600	142,000	145,000 e/	180,000	180,000
Lubricants e/	do.	7,400	7,500	7,500	4,200	4,000
Other e/	do.	17,000	18,000	19,000	17,000	18,000
Refinery fuel and losses e/	do.	4,000	4,000	4,000	4,000	4,000
Total e/	do.	269,000	353,000	360,000	447,000	453,000

e/ Estimated. r/ Revised.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Table includes data available through Apr. 27, 1995.

3/ Reported figure.

TABLE 2  
REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity	
Aluminum, primary	Aluminium of Korea Ltd.	Ulsan	18	
Bismuth, metal	metric tons	Korea Tungsten Mining Co. Ltd.	Sangdong	135
Cement	Ssangyong Cement Industrial Co. Ltd.	Yongwol	11,500	
Copper, metal	Lucky Metals Ltd.	Changhang	50	
Do.	do.	Onsan	175	
Graphite	Kaerion Graphite Ltd.	Kangwon	25	
Do.	Wolmyong Mining Co.	do.	26	
Lead, metal	Lucky Metals Co. Ltd.	Changhang	15 1/	
Do.	Korea Zinc Co. Ltd.	Onsan	100	
Nickel, metal	Korea Nickel Corp.	do.	12	
Steel	Pohang Iron and Steel Co. Ltd. (35% government owned)	Kwangyang	11,400	
Do.	do.	Pohang	9,400	
Talc	Dongyang Talc Mining Co.	Chungju	NA	
Tungsten, in ore	Korea Tungsten Mining Co. Ltd.	Sangdong	3 2/	
Zinc, metal	Korea Zinc Co. Ltd.	Onsan	170	
Do.	Young Poong Corp.	Sukpo	75	

NA Not available.

1/ Closed in 1990.

2/ Closed in 1992.

TABLE 3  
REPUBLIC OF KOREA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1994

(Thousand metric tons unless otherwise specified)

Commodity	Reserves 1/
Asbestos	1,400
Bismuth	56
Coal, anthracite	1,580,000 2/
Diatomaceous earth	8,200
Feldspar	36,000
Graphite	16,000
Iron, in ore	62,000
Kaolin	240,000
Mica	9,900
Pyrophyllite and talc	150,000
Tungsten, in ore	250
Zinc, in ore	2,700

1/ As of Dec. 31, 1990.

2/ As of Dec. 31, 1991.

Source: Korea Yearbook of Energy Statistics, 1993.